

Hemoglobin Correlation with Jaundice in Rh-Negative Mothers: A Prospective Observational Study

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Abstract

Background: Neonatal jaundice, or hyperbilirubinemia, is frequently observed among newborns, particularly those born to Rh-negative mothers. Rh incompatibility can lead to hemolysis and elevated bilirubin levels.

Objective: To assess the correlation between hemoglobin levels and neonatal jaundice in Rh-negative mothers.

Methods: A hospital-based prospective observational study was conducted among 104 Rh-negative pregnant women. Data included blood group incompatibility, delivery method, gravidity, administration of anti-D immunoglobulin, Coombs test results, hemoglobin (HB) levels, and bilirubin concentration in neonates.

Results: A significant number of neonates exhibited elevated bilirubin levels and Coombs test positivity, especially among mothers who did not receive anti-D prophylaxis. Chi-square analysis revealed a significant association between Rh incompatibility and Coombs positivity ($p < 0.002$).

Conclusion: Rh incompatibility strongly correlates with neonatal jaundice. Lack of anti-D prophylaxis is a contributing factor. Monitoring and timely prophylaxis can help prevent hemolytic disease of the newborn.

Keywords: Rh incompatibility, Neonatal jaundice, Hyperbilirubinemia, Anti-D prophylaxis, Coombs test, Hemolysis.

Introduction

Neonatal jaundice is one of the most frequently encountered clinical conditions in newborn nurseries, primarily due to elevated serum bilirubin levels exceeding 5 mg/dL. While often benign and self-limiting, severe cases may indicate underlying pathologies such as hemolytic disease of the newborn (HDN), particularly in cases involving Rh incompatibility [1].

Rh incompatibility occurs when a Rh-negative mother carries an Rh-positive fetus, leading to maternal alloimmunization and the production of antibodies that target fetal red blood cells. This immunological response can result in significant hemolysis, neonatal jaundice, anemia, and in severe cases, hydrops fetalis or fetal demise. Historically, HDN was a leading cause of neonatal morbidity and mortality. Before the widespread adoption of Rh immunoprophylaxis, it affected approximately 1% of all newborns and contributed to the death of 1 in every 2,200 live births. The introduction of anti-D immunoglobulin and advances in perinatal care have since led to a dramatic reduction in HDN cases, lowering the incidence to approximately 1 in 21,000

births and reducing mortality due to Rh alloimmunization from 46 per 100,000 births before 1969 to just 1.6 per 100,000 by 1990. However, this success is not uniformly observed across all populations [2-4]. In resource-limited settings, missed opportunities for anti-D administration, inadequate prenatal screening, and poor access to maternal care continue to contribute to cases of HDN and neonatal hyperbilirubinemia. Moreover, shifts in population demographics, variations in Rh-negative prevalence, and changing obstetric practices may also influence disease trends.

This study aims to examine current patterns in the presentation and outcomes of hyperbilirubinemia among neonates born to Rh-negative mothers, with a particular focus on maternal hemoglobin levels, Coombs test results, anti-D prophylaxis, and neonatal blood group. Understanding these factors may provide insights into the ongoing challenges in preventing and managing Rh incompatibility-related neonatal jaundice.

Materials and Methods

Study Design: A prospective observational study was conducted at the Muslim Maternity and Children's

Hospital, Hyderabad.

Study Duration: August to September 2024.

Sample Size: 104.

Inclusion Criteria: Pregnant women with the age ≥ 18 years, Rh-negative blood group, willing to provide informed consent are included in the study.

Exclusion Criteria: Age < 18 years, missing/incomplete medical records are excluded from the study.

Data Collected: Maternal and fetal blood group, gravida status, hemoglobin levels, delivery type, anti-D prophylaxis history, neonatal bilirubin levels, Coombs test results

Statistical Analysis: Chi square test was used to know the significant difference between the variables.

Study Results: Neonatal Jaundice and Rh Incompatibility

The findings of this study reveal the following key characteristics among the neonates admitted with jaundice due to Rh incompatibility:

61.54% were female babies.

51.92% were delivered by LSCS.

88.46% were born to multigravida women.

53.85% had mothers with O-negative blood group.

53.85% of neonates had hemoglobin levels in the 11–15 g/dL range.

30.77% of the fetuses had a B-positive blood group.

57.69% of participants received Anti-D immunoglobulin.

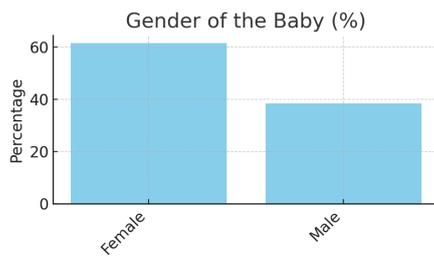
57.69% of babies were Coombs positive.

57.69% of babies had no comorbidities.

46.15% had serum bilirubin levels in the 6–10 mg/dL range.

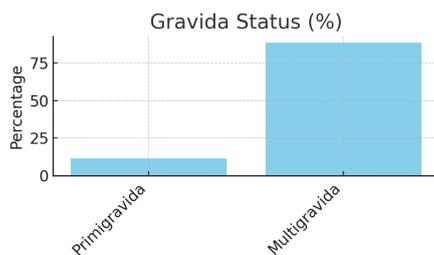
Gender of the Baby

Category	Number	Percentage
Female	64	61.54
Male	40	38.46



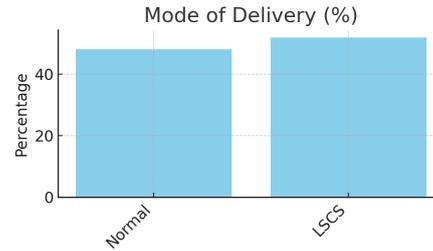
Gravida Status

Category	Number	Percentage
Primigravida	12	11.54
Multigravida	92	88.46



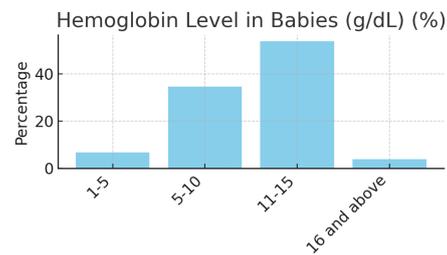
Mode of Delivery

Category	Number	Percentage
Normal	50	48.08
LSCS	54	51.92



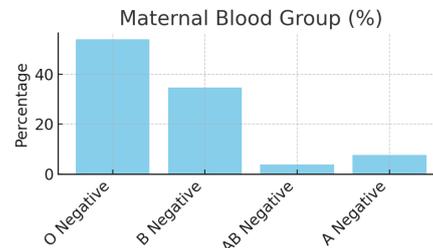
Hemoglobin Level in Babies (g/dL)

Category	Number	Percentage
1-5	7	6.73
5-10	36	34.62
11-15	56	53.85
16 and above	4	3.85



Maternal Blood Group

Category	Number	Percentage
O Negative	56	53.85
B Negative	36	34.62
AB Negative	4	3.85
A Negative	8	7.69



Statistical Analysis Results

Method Used: Chi-square test

Findings:

- The comparison between Rh factor and Coombs test was statistically significant ($P < 0.002$, which is less than the significance level of $\alpha = 0.005$).
- The comparison between Anti-D administration and Coombs test was statistically significant ($P < 0.002$, which is less than the significance level of $\alpha = 0.005$).

Distribution of Delivery Method by Gestational Age

Gestational Age	LSCS	Normal Delivery	Total Women
36 weeks	4	0	4
36+4 weeks	4	4	8
37 weeks	0	4	4
37+2 weeks	0	4	4
37+4 weeks	4	0	4
37+5 weeks	4	0	4
37+6 weeks	0	4	4
38 weeks	12	0	12
38+2 weeks	3	1	4
38+5 weeks	0	4	4
39 weeks	8	24	32
39+3 weeks	0	4	4
39+4 weeks	0	4	4
Total	39	57	96

Overall Summary

Delivery Method Breakdown:

- LSCS: 51.92%
- Normal: 48.08%

Discussion

Our findings align with previously published literature indicating that Rh incompatibility can significantly contribute to neonatal jaundice. Most mothers in our study were multigravida and had not received anti-D prophylaxis. A strong correlation was observed between Rh-negative status and Coombs positivity in neonates ($p < 0.002$). This matches findings by Lalrinkimi et al., who noted that O-negative mothers are more likely to have infants with jaundice. Statistical difference was found when Anti-D was compared against Coombs test ($P < 0.002$, which is less than the significance level of $\alpha = 0.005$) which is similar to the study conducted by [1-4]. The most common neonatal blood group associated with jaundice in our study was B-positive, like results from [1-6]. The proportion of neonates with bilirubin levels between 6–10 mg/dL suggests moderate jaundice that could escalate if not monitored. The data supports aggressive prophylaxis programs and early intervention strategies for Rh-negative mothers to reduce the risk of HDN.

Conclusion

The data suggests that most of the neonates affected by jaundice were female and delivered via lower segment cesarean section (LSCS). Most had hemoglobin levels ranging between 11–15 g/dL. Among the mothers, those with O-negative blood type showed the highest prevalence. B-positive was the most common blood group among the jaundiced infants. Notably, 57.69% of the cases involved mothers who had not received anti-D immunoglobulin during pregnancy. A direct Coombs test was positive in 57.69% of the neonates, indicating hemolytic disease of the newborn. Additionally, 46.15% of the infants had serum bilirubin levels in the range of 6–10 mg/dL, confirming the presence of hyperbilirubinemia. Rh incompatibility remains a clinically relevant cause of neonatal jaundice. Hemoglobin levels and lack of anti-D administration are contributing factors. Early detection and universal administration of Rh immunoglobulin can minimize the risk and burden of hemolytic disease in neonates.

Author Contributions

Nida Ali Safdar, Essra Ali Safdar, Sana Amreen, and Humaira Fatima contributed to data collection and investigation. Soha Jabeen and Irshad Mustafa were involved in the conceptualization, study design, and supervision of the research. Sheereen Shoukath Khan contributed to data analysis and interpretation. Soha Jabeen prepared the original draft of the manuscript and coordinated revisions. All authors participated in reviewing and editing the manuscript, approved the final version, and agree to be accountable for all aspects of the work.

Ethical Statement

The study was conducted in accordance with the ethical standards of the Institutional Ethics Committee and in compliance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the appropriate Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants, and confidentiality and anonymity of patient data were strictly maintained throughout the study.

Conflict of Interest Statement

The authors declare that they have no conflicts of interest regarding the publication of this manuscript.

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Informed Consent Statement: Written informed consent was obtained from all participants involved in the study.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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